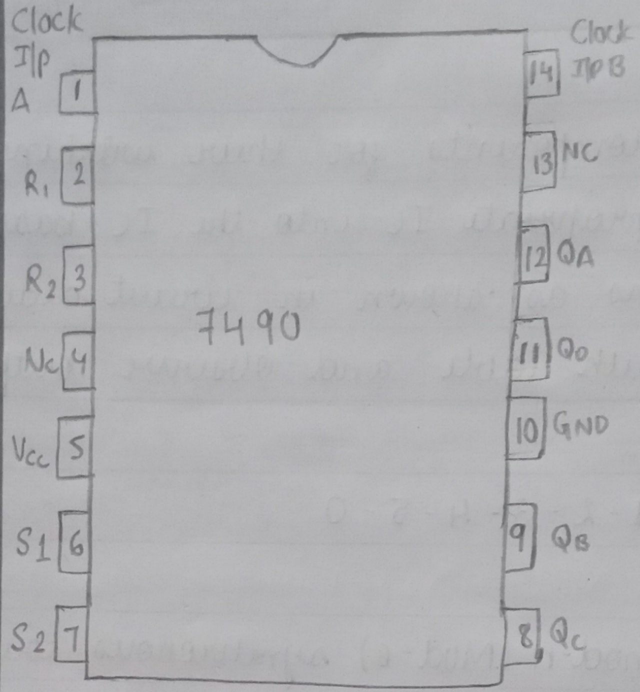
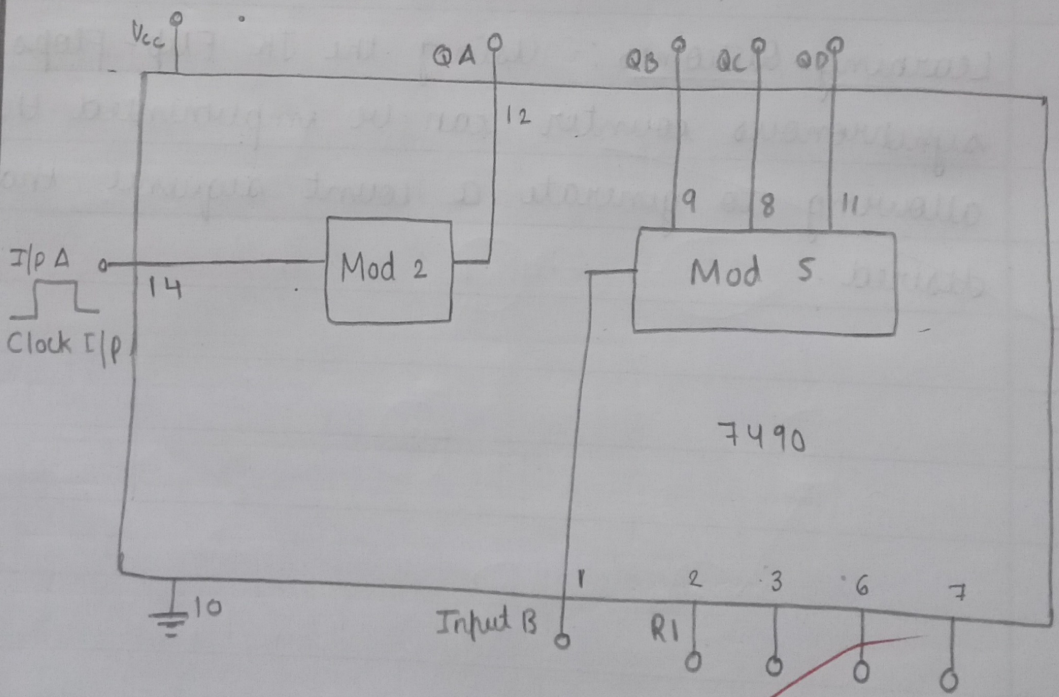
IC pin Diagram:



BCD Counter



CAMBRIDGE INSTITUTE OF TECHNOLOGY
AN AUTONOMOUS INSTITUTION

DD MM YYYY
28 10 2024

EXPERIMENT NO-05

Title :- Design asynchronous counter.

problem Description :- Design a counter for the sequence 0-1-2-3-4-5-6-7-8-9 and display them on 7-segment LED display.

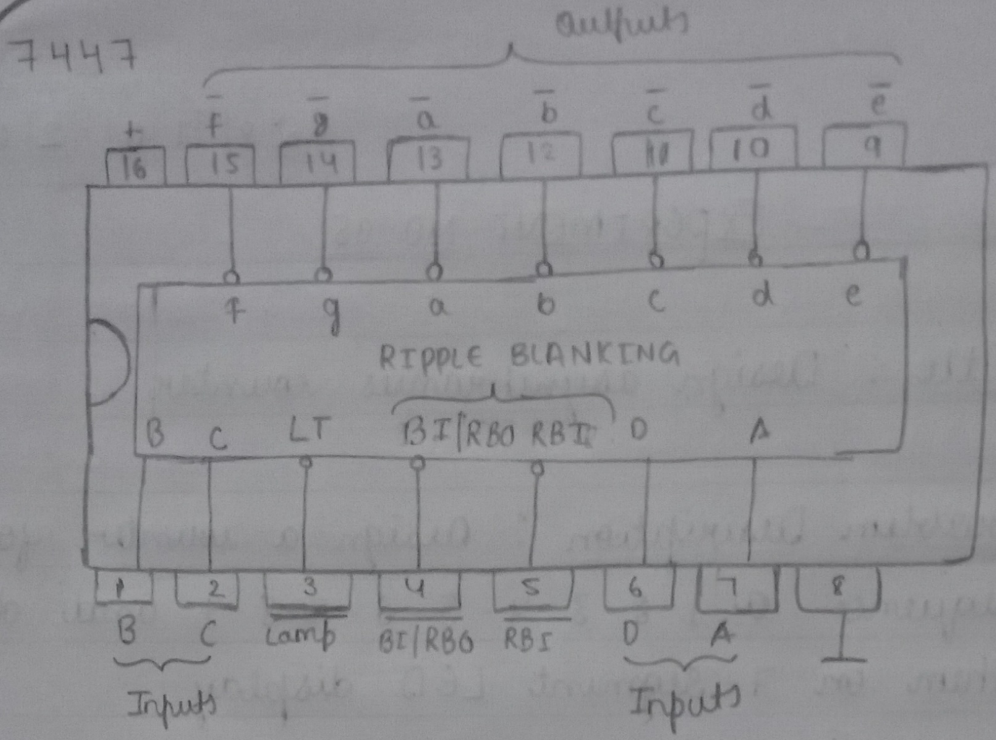
Learning Objectives :-

* To learn about asynchronous counter and decade counter.
* To learn and understang the working of IC 7490
* To underatand the working of mod-n asynchrono-us countar using decade counter.

AIM :- Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) and demonstrate on 7-segment display (using IC-7447)

Equipment Required :-

IC 7490 - Decade Counter - 1 No, IC 7411 - Triple



Mod - 10 - Counter [count up from 0 to 9]

Clk	Counter output (7490)				Decimal o/p of 7 segment
	Q_A	Q_B	Q_C	Q_D	
0	0	0	0	0	0
1	0	0	0	1	1
2	0	0	1	0	2
3	0	0	1	1	3
4	0	1	0	0	4
5	0	1	0	1	5
6	0	1	1	0	6
7	0	1	1	1	7
8	1	0	0	0	8
9	1	0	0	1	9

CAMBRIDGE
INSTITUTE OF TECHNOLOGY
AN AUTONOMOUS INSTITUTION

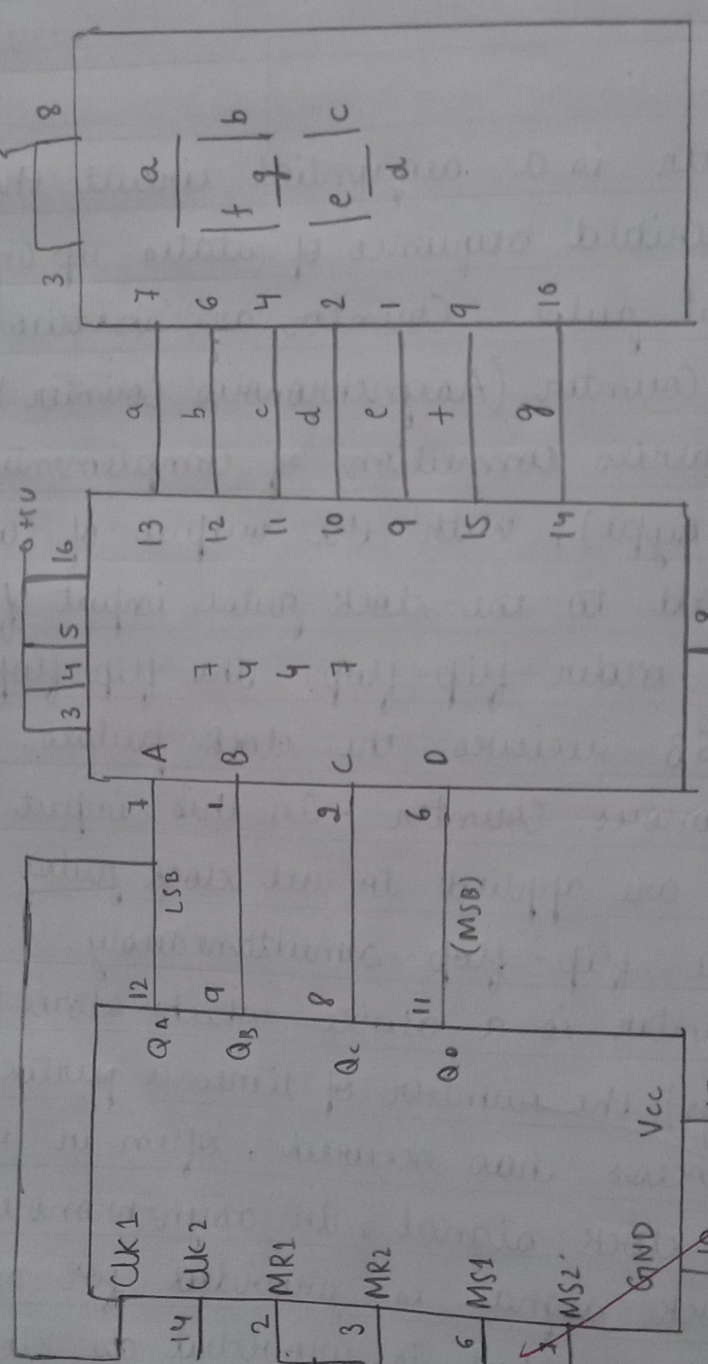
D D M M Y Y Y Y

input AND Gate - 1 No, IC 7447 - 7 Segment display - 1 No, Digital IC Trainer Kit & patch Cords.

Theory :-

A Counter is a sequential circuit that goes through a prescribed sequence of states up on application of input pulse. Counter are in two categories -
Ripple Counter (Asynchronous Counter) - It consists of a series connection of complementing flip flops (T|JK type), with the output of each flip-flop connected to the clock pulse input of the next higher order flip-flop. The flip-flop holding the LSB recieves the clock pulses.
Synchronous Counter - In this input pulses/clock pulses are applied to all clock pulse inputs of all the flip-flop simultaneously.
A counter is a device which stores (and sometimes displays) the number of times a particular event or process has occured, often in relationship to a clock signal. In asynchronous counter a clock signal is provided for one flip-flop and its output is provided as clock source

CIRCUIT DIAGRAM:-



for next flip-flop. The output of asynchronous counter is not synchronized with clock signal. A decade counter follows a sequence of 10 states and returns to zero after the count of nine. Such a counter must have at least 4 flip flops to represent each decimal digit since a decimal digit is represented by a binary code with at least 4 bits.

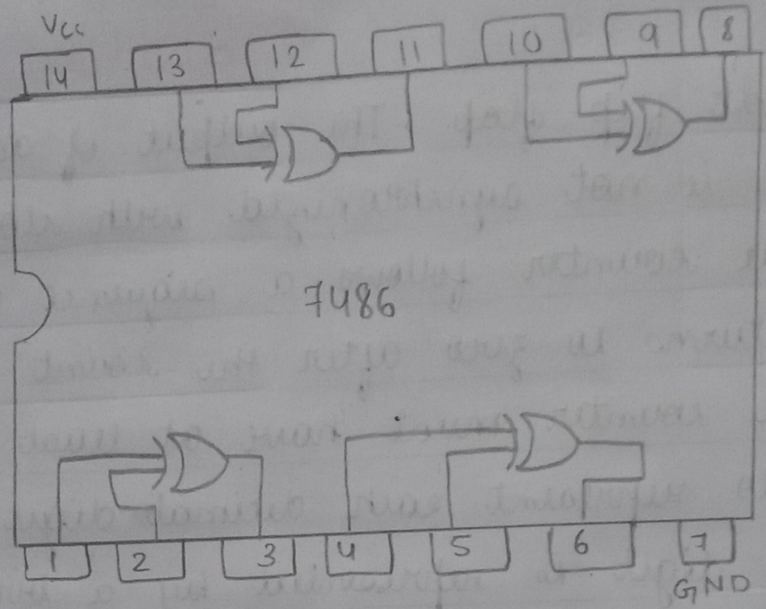
Procedure :-

1) Check all the components for their working.
2) Insert the appropriate IC into IC base.
3) Make connections as shown in circuit diagram
4) Verify the Truth Table and observe the outputs.

Results :- An asynchronous counter using a decade counter is designed and the truth table is verified for the same.

Learning Outcomes :- By using a decade counter we can obtain an appropriate decimal number

IC pin Diagram :-



Quad 2 Input Ex-OR Gate

Truth table

Binary				Gray Code			
b3	b2	b1	b0	g3	g2	g1	g0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	1
0	0	1	1	0	0	1	0
0	1	0	0	0	1	1	0
0	1	0	1	0	1	1	1
0	1	1	0	0	1	0	1
0	1	1	1	0	1	0	0
1	0	0	0	1	1	0	0
1	0	0	1	1	1	0	1
1	0	1	0	1	1	1	1
1	0	1	1	1	1	1	0
1	1	0	0	1	0	1	0
1	1	0	1	1	0	1	1
1	1	1	0	1	0	0	1
1	1	1	1	1	0	0	0

CAMBRIDGE INSTITUTE OF TECHNOLOGY
AN AUTONOMOUS INSTITUTION

DD MM YYYY
28 10 2024

EXPERIMENT - 06

Title :- Code Converters

Learning Objectives :-

* To learn the importance of non-weighted code.
* To learn to generate gray code.

Aim :- Design and implement code converter - Binary to Gray.

Equipment Required :- IC 7407(2) - NOT Gate, IC7408(2) - AND Gate, IC7432(1) - OR Gate, IC7486(1) - XOR Gate, Digital IC Trainer Kit and patch Cards.

Theory :-

Binary Codes :- A symbolic representation of data/ Information is called code. The base or radix of the binary number is 2. Hence, it has two independent symbols. The symbols used are 0 and 1. A binary digit is called as a bit. A binary number consists of sequence of bits, each of which is either a 0 or 1. Each bit carries a weight

K-Map

G3:

B_3B_2 \ B_1B_0	00	01	11	10
00				
01				
11	1	1	1	1
10	1	1	1	1

G1 :-

B_3B_2 \ B_1B_0	00	01	11	10
00			1	1
01	1	1		
11	1	1		
10			1	1

G2:-

B_3B_2 \ B_1B_0	00	01	11	10
00				
01	1	1	1	1
11				
10	1	1	1	1

G0 :-

B_3B_2 \ B_1B_0	00	01	11	10
00		1		1
01		1		1
11		1		1
10		1		1

G3 :-

G_3B_2 \ B_1B_0	00	01	11	10
00				
01				
11	1	1	1	1
10	1	1	1	1

B1 :-

G_3G_2 \ G_1G_0	00	01	11	10
00			1	1
01	1	1		
11			1	1
10	1	1		

B2:-

B_3B_2 \ B_1B_0	00	01	11	10
00				
01	1	1	1	1
11				
10	1	1	1	1

B0:-

G_3G_2 \ G_1G_0	00	01	11	10
00		1		1
01	1		1	
01		1		1
10	1		1	

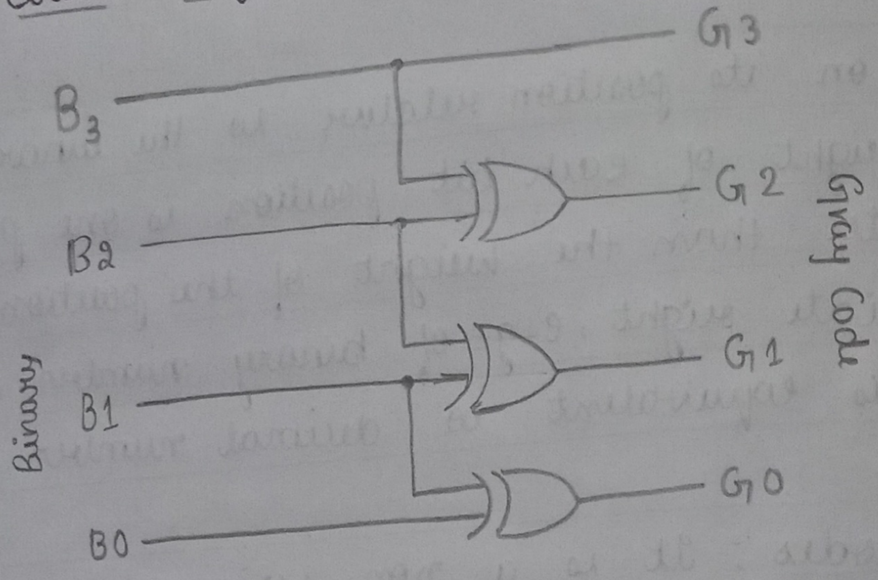
based on its position relative to the binary point. The weight of each bit position is one power of 2 greater than the weight of the position to its immediate right, e.g. of binary number is 100011 which is equivalent to decimal number 35.

<u>Gray Codes</u> :- It is a non-weighted code; therefore, it is not a suitable for arthimetic operations. It is a cyclic code because successive code words in this code differ in one bit position only i.e. it is a unit distance code.

<u>Applications of Gray Code</u> :- In instrumentation and data acquisition system where linear or angular displacement is measured. In shaft encoders, input-output devices, A/D converters and other peripheral equipment

<u>Code Converters</u> :- The availability of a large variety of codes for the same discrete elements of information results in the use of different codes by different digital systems. It is some time necessary to use the output of one system as the

Circuit Diagram :-



Boolean Expressions (Binary - to - Gray) :

$G3 = B3$

$G2 = B3 \oplus B2$

$\quad = B3\overline{B2} + \overline{B3}B2$

$G1 = B1 \oplus B2$

$\quad = B1\overline{B2} + \overline{B1}B2$

$G0 = B1 \oplus B0$

$\quad = B1\overline{B0} + \overline{B1}B0$

input to other. The conversion circuit must be inserted between the two systems if each uses different codes for the same information. Thus a code converter is a circuit that makes the two systems compatible even though each uses the different code.

<u>procedure</u> :-

1) Check all the components for their working.
2) Insert the appropriate IC into the IC base.
3) Make connections as shown in circuit diagram.
4) Verify the Truth table and observe the outputs.

<u>Results</u> :- Binary to gray code conversion and vice versa is realized using basic gates

<u>Learning</u> <u>Outcomes</u> :- Binary to gray code conversion and vice versa is implemented using basic gates.

12/11/24